Space Weather Technical Forecast

Issued on Saturday, 26 February 2022 at 00:28 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Increasing electron fluence probable. Slight chance of G1/Minor Storm and R1/Minor radio blackouts.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is low with three small and simple unipolar active regions on the visible disc, and no significant flares. No Earth-directed CMEs were observed in the available imagery during the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR and ACE at L1, was at slightly elevated levels throughout and declined from around 480 km/s to 420 km/s. The density was at average to slightly above average levels, peaking at 12 ppcc at 25/0828 UTC. The IMF, Bt, was weak although did approach 8nT at times. The north-south component, Bz, varied weakly between +7nT and -6nT. Phi angle was largely positive (away from the Sun). Resultant geomagnetic activity was Quiet to Unsettled (Kp 0-3).

Energetic Particles / Solar Radiation: The high energy proton flux (10MeV) measured at GOES 16 was at background levels. The high energy electron flux (greater than 2MeV) has been at normal background to moderate levels, peaking at 898 pfu at 25/1720 UTC. The corresponding 24-hour integrated electron fluence remained flatly below the Active (1e8 integrated pfu) threshold with the 26/0000 UTC observation showing 2.98e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be low or very low, with a chance of C-class flares. Risk of M-class flares is slight currently with an increasing chance as new regions rotate onto the disc in the coming days.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are forecast. A selection of coronal hole high speed stream (HSS) connections are expected during this period, with winds likely to exceed 500km/s at times. Geomagnetic activity is expected to be Quiet to Unsettled, with a chance of Active periods, and a slight chance of G1/Minor Storm intervals.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. High energy electron flux is likely to follow an erratic rising trend, with the likelihood of exceeding the high (1e3pfu) threshold during diurnal peaks. Electron fluence is also forecast to follow a rising trend, and may approach to lie just below the Active (1e8 integrated pfu) threshold. Confidence is low however.

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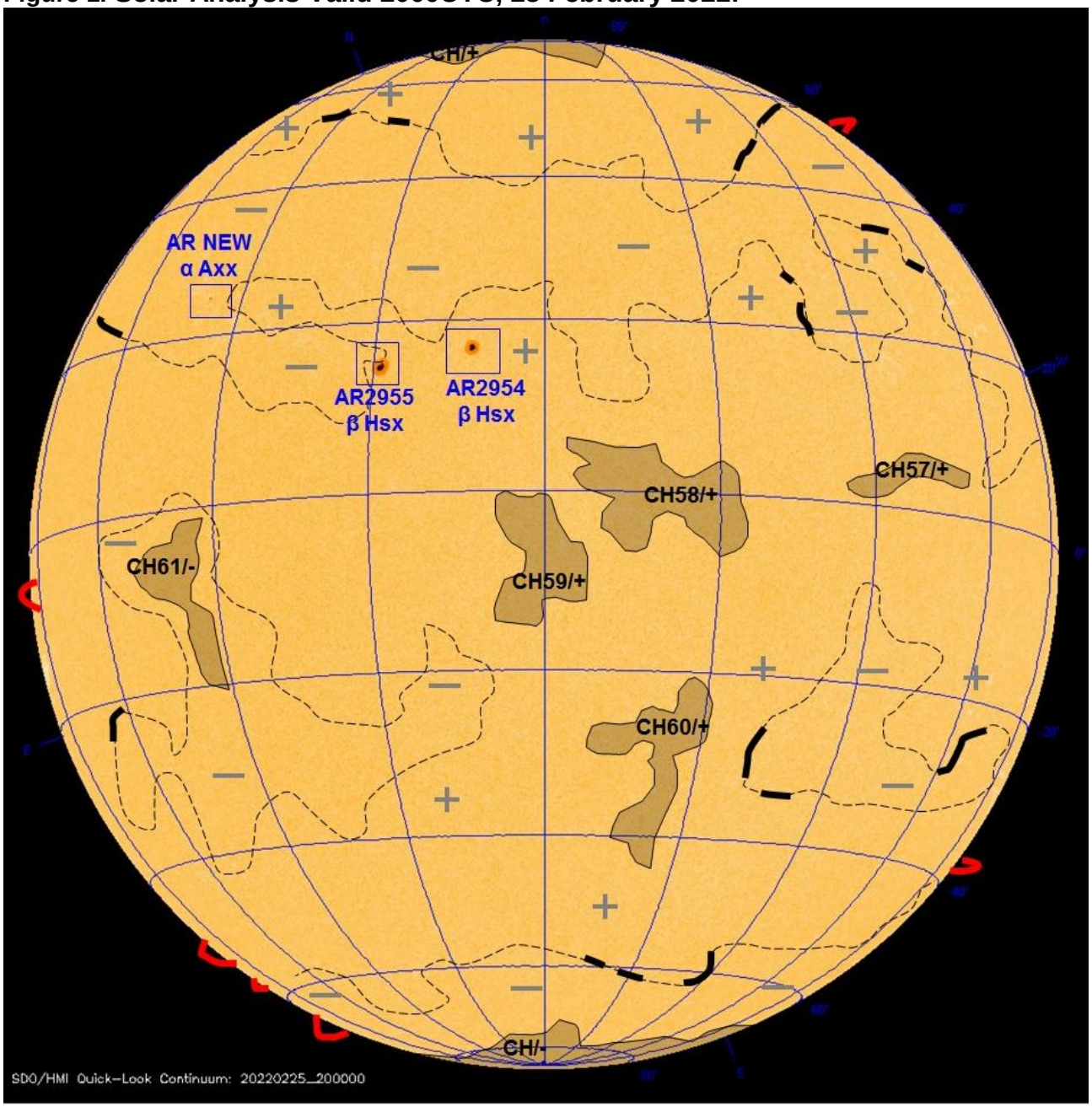
Figure 1. Solar Analysis Valid 2000UTC, 25 February 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs forecast.

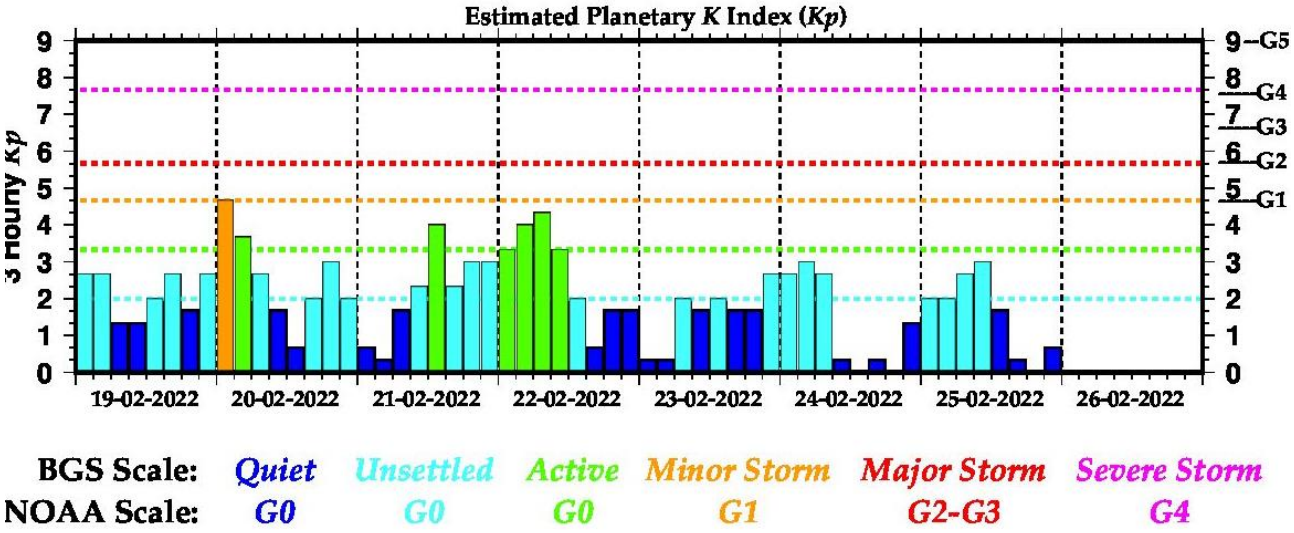
The high speed stream from coronal hole 57 is probably currently connected to Earth with slightly elevated solar winds observed. A further connection with coronal hole 58 is likely on Days 1 or 2 (26-27 Feb). A connection with coronal hole 59 is then probable on Days 2 or 3 (27-28 Feb). Solar wind speeds from these holes are expected to exceed 500km/s at times, and it is probable that the effects will run into one another, making it difficult to tell the individual features apart when they arrive at L1. These features appeared weaker in imagery on the previous rotation, and wind speeds from the previous rotation were also contaminated by CME arrivals. The upcoming coronal holes are all positive polarity, which are less favoured for a geomagnetic response at this time of year. As such, geomagnetic activity is expected to be Quiet to Unsettled, with a chance of Active periods, and a slight chance of G1/Minor Storm intervals throughout.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: BGS geomagnetic activity over the past week.



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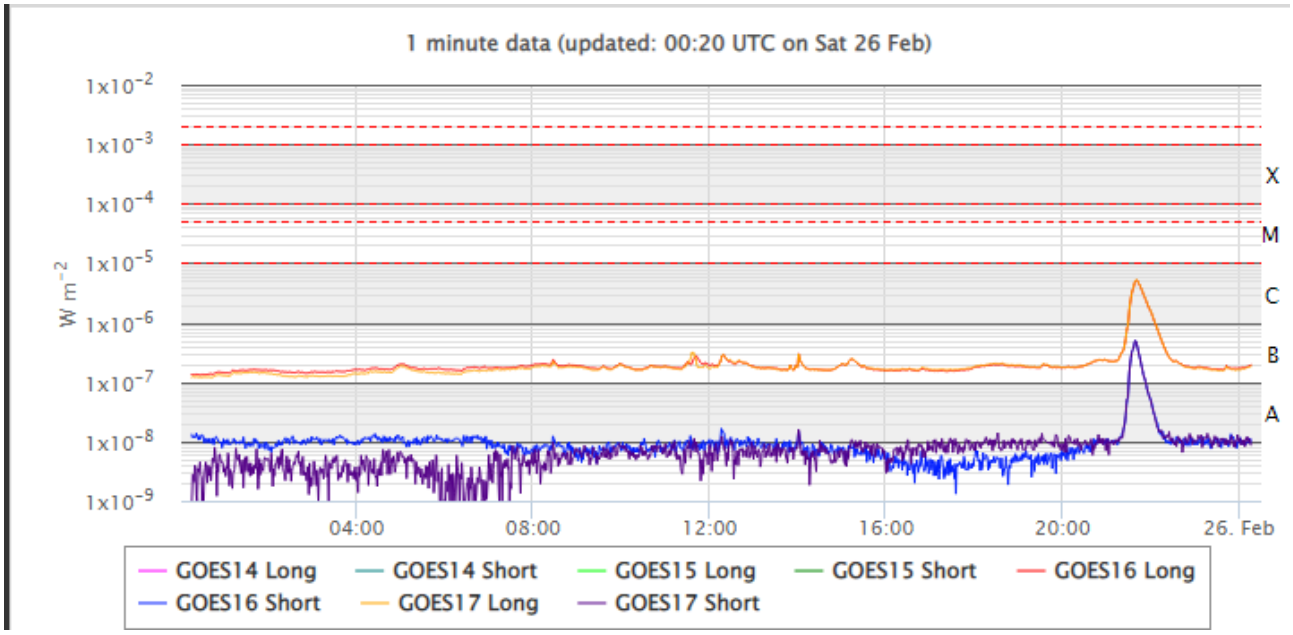
Radio Blackouts - X-Ray Flares:
Solar activity is low, with three mature and apparently stable sunspots on the visible disc. AR2954 and AR2955 are both classified as Hsx/Alpha and have shown little activity and a new sunspot has emerged in the northeast and classified as Axx/Alpha. Further active regions are expected to rotate onto the visible disc in the coming days, with farside imagery suggesting that these could present a slight risk (0-20%) of M-class flares, and this chance will probably increase as the new regions emerge across the disc from the far-side. A C5 flare observed at 25/2143 UTC appears to have originated from one of these regions and may have been from either Ex 2939 or Ex 2944 which were observed during the previous rotation.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: X-ray flux plot with the recent C-Class flare observed at 25/2143 UTC



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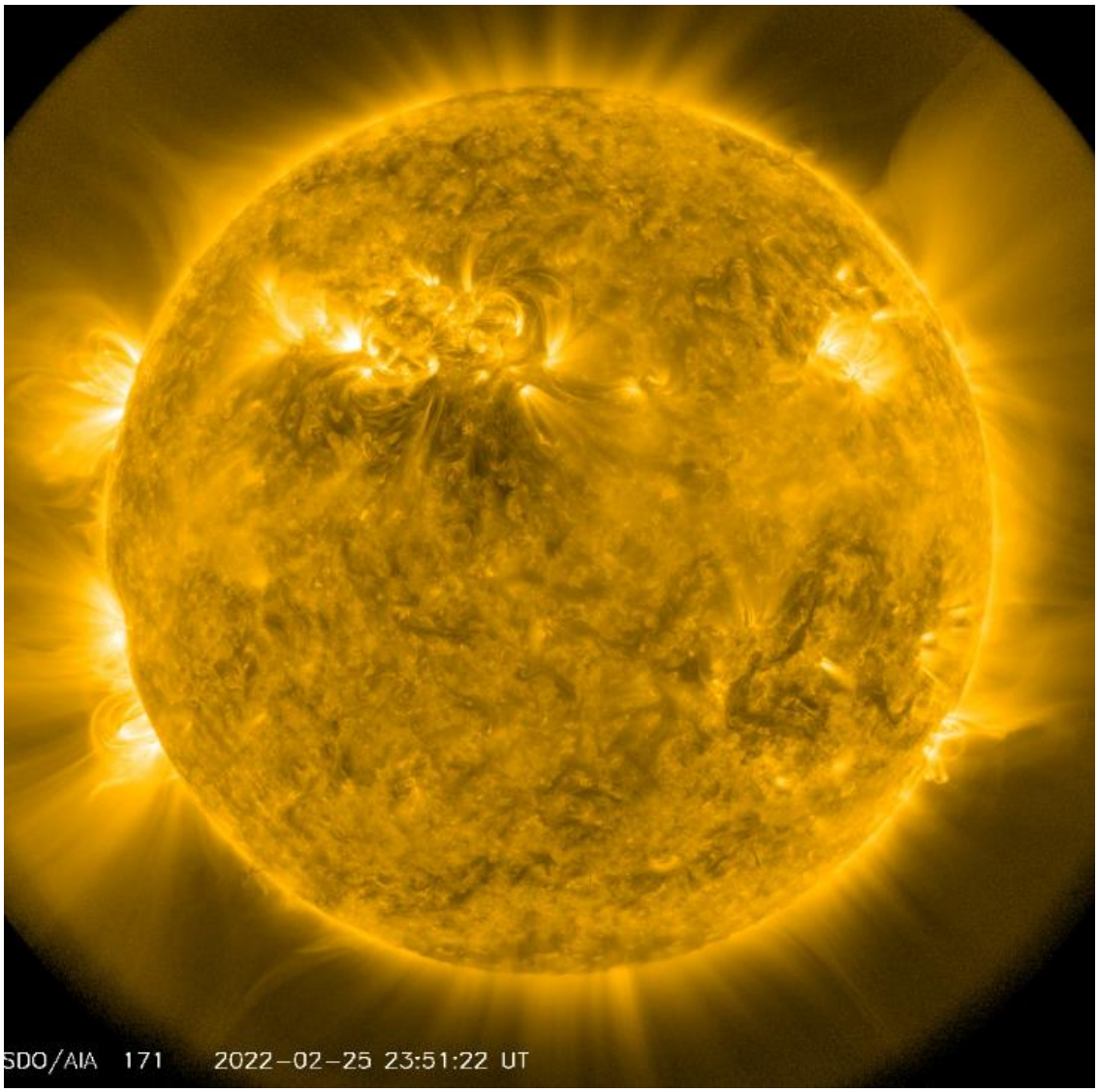
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (10MeV) measured at GOES 16 is at background levels, and expected to remain at this level with no solar radiation storms occurring.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: SDI-aia 171 satellite imagery with active regions on the eastern limb becoming visible.



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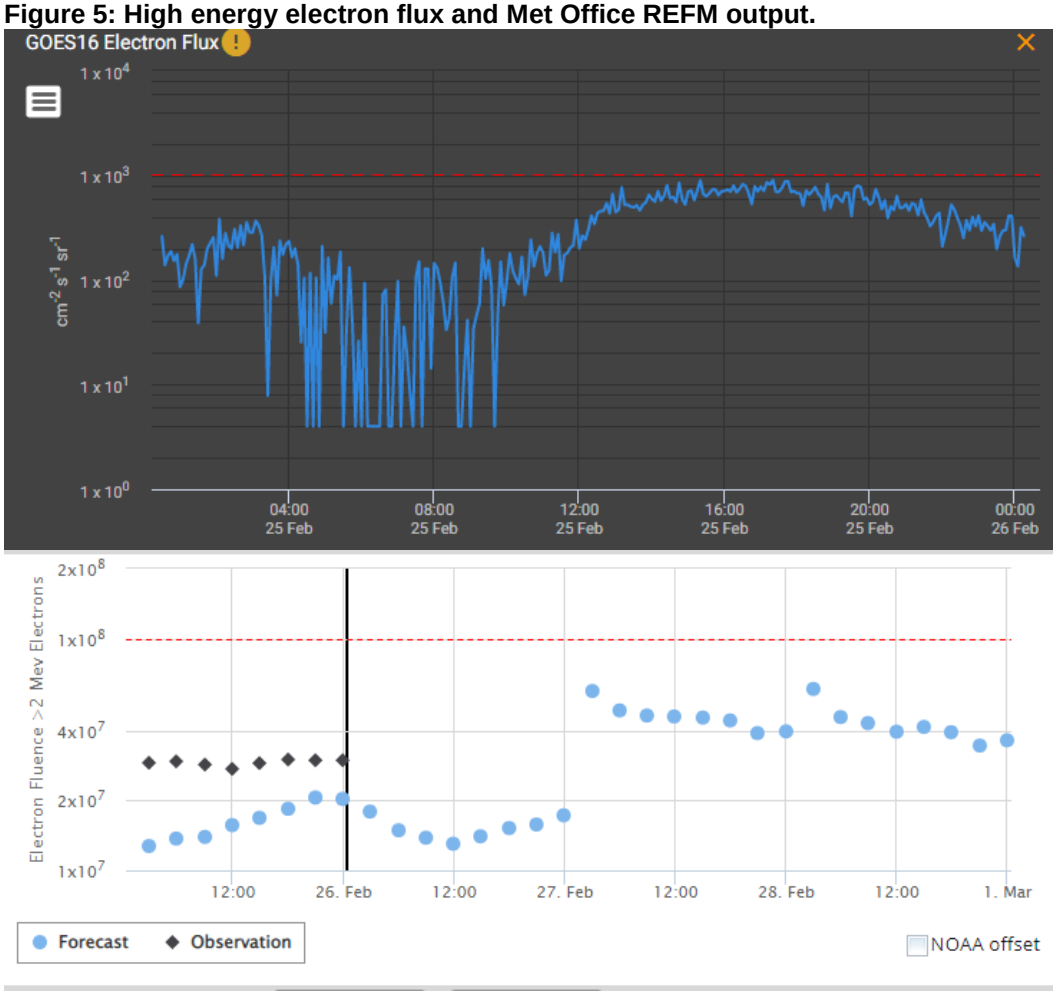
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) has reached moderate levels at the diurnal maxima in recent days, with an increasing trend in the diurnal peak. With earth expected to be affected by various high speed streams in the coming days further charging will occur. Any CIR associated with these arrivals may cause temporary suppressions, however a general increasing trend is most probable over coming days, but with some variation in the peak values day to day. Associated electron fluence is likely to rise due to charging from the various high speed streams, but will probably stay just below the Active (1e8 integrated pfu) threshold. Confidence is low however, due to the uncertainty surrounding the charging / suppression cycle of several high speed streams in the coming days.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\ sr^{-1}\ day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	20	30	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: High energy electron flux and Met Office REFM output.



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